

Eco-centric
architecture

| The mudflat symbionts

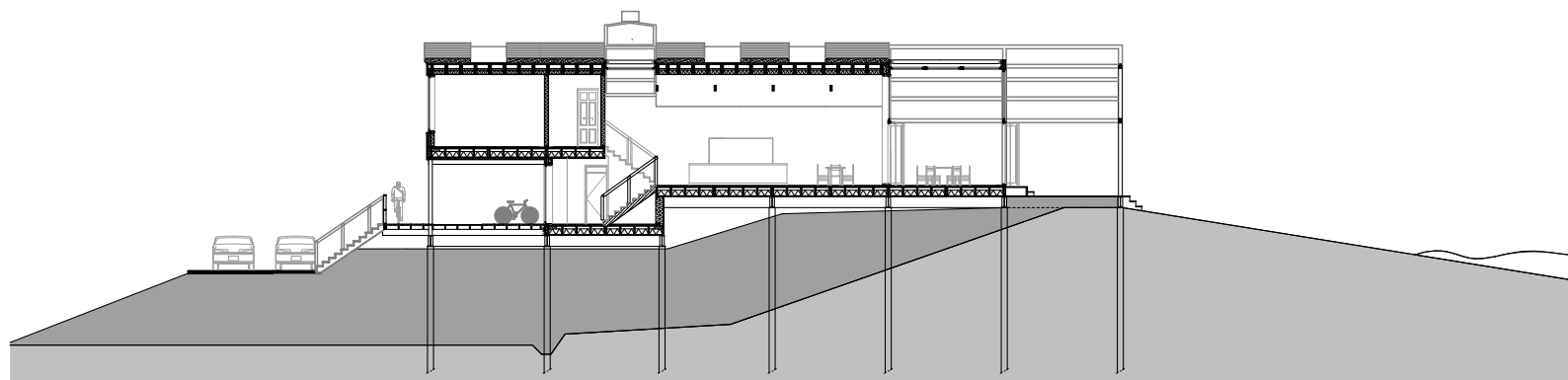
Building technology

AR3TT015 Transitional Territories
MSc Architecture, Technical University Delft

Anneloes van Slooten

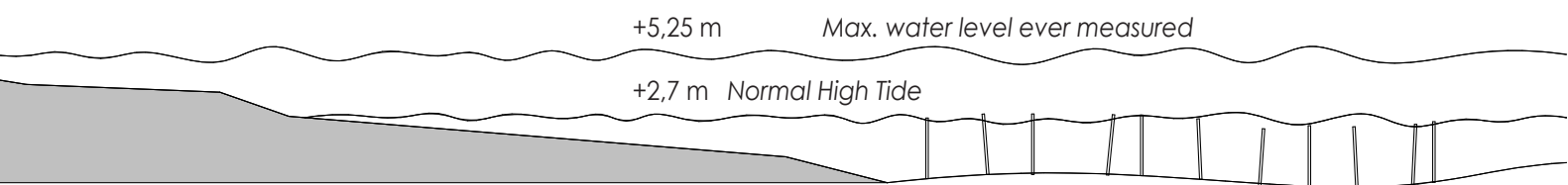
Student number: 4655230

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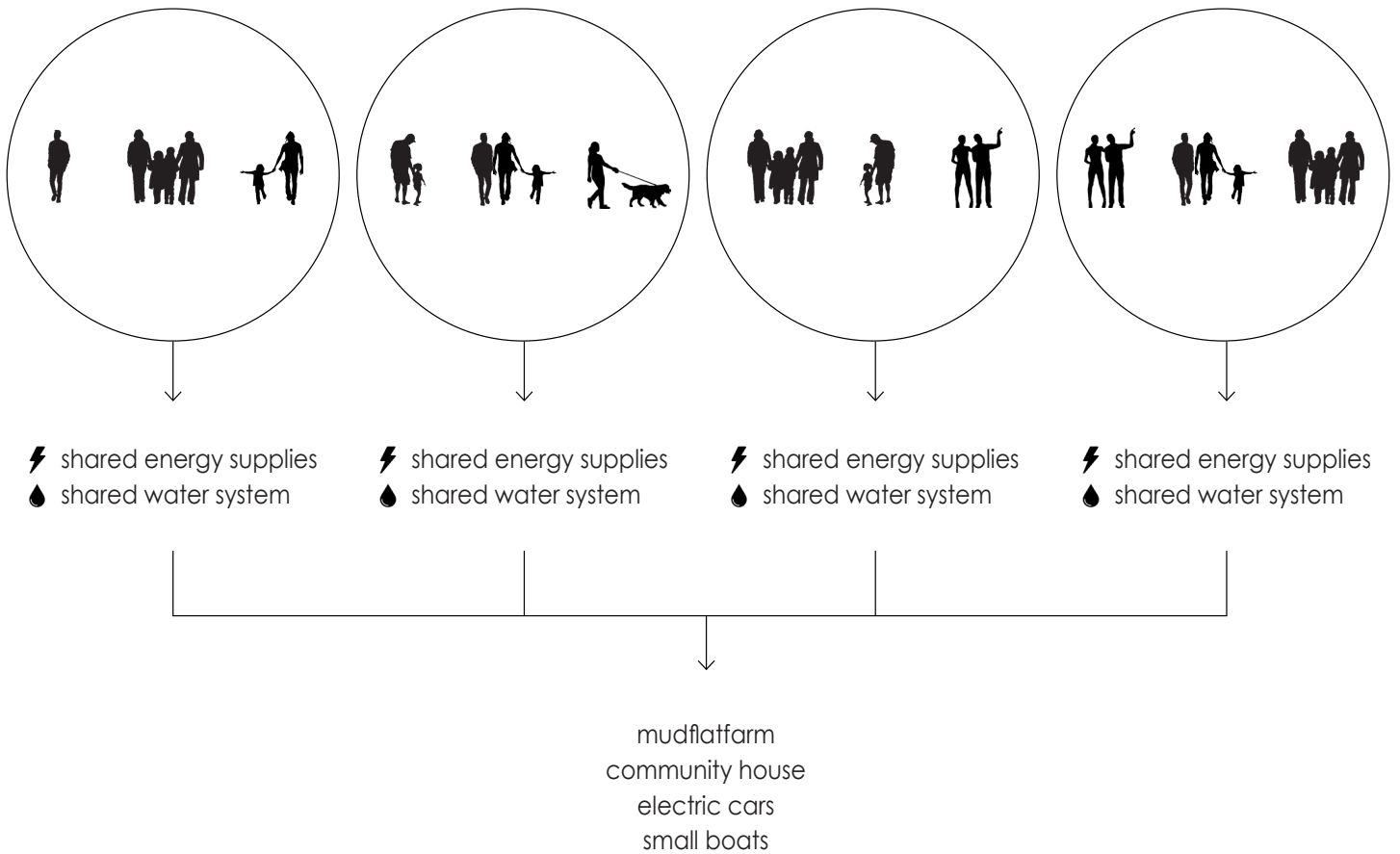
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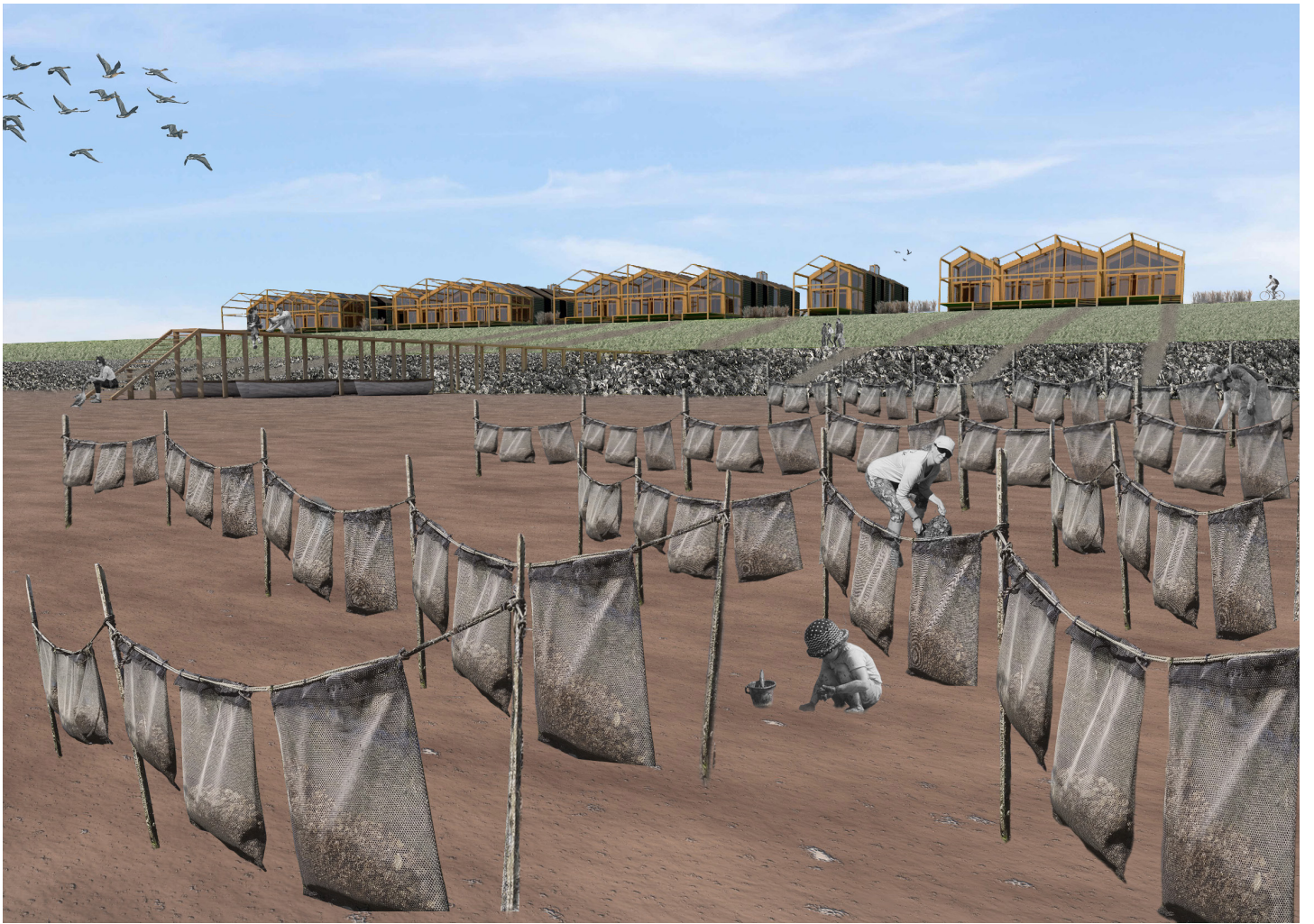
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Together on the edge between land and sea
The mudflat symbionts

4 clusters with 3 different households:





East facade



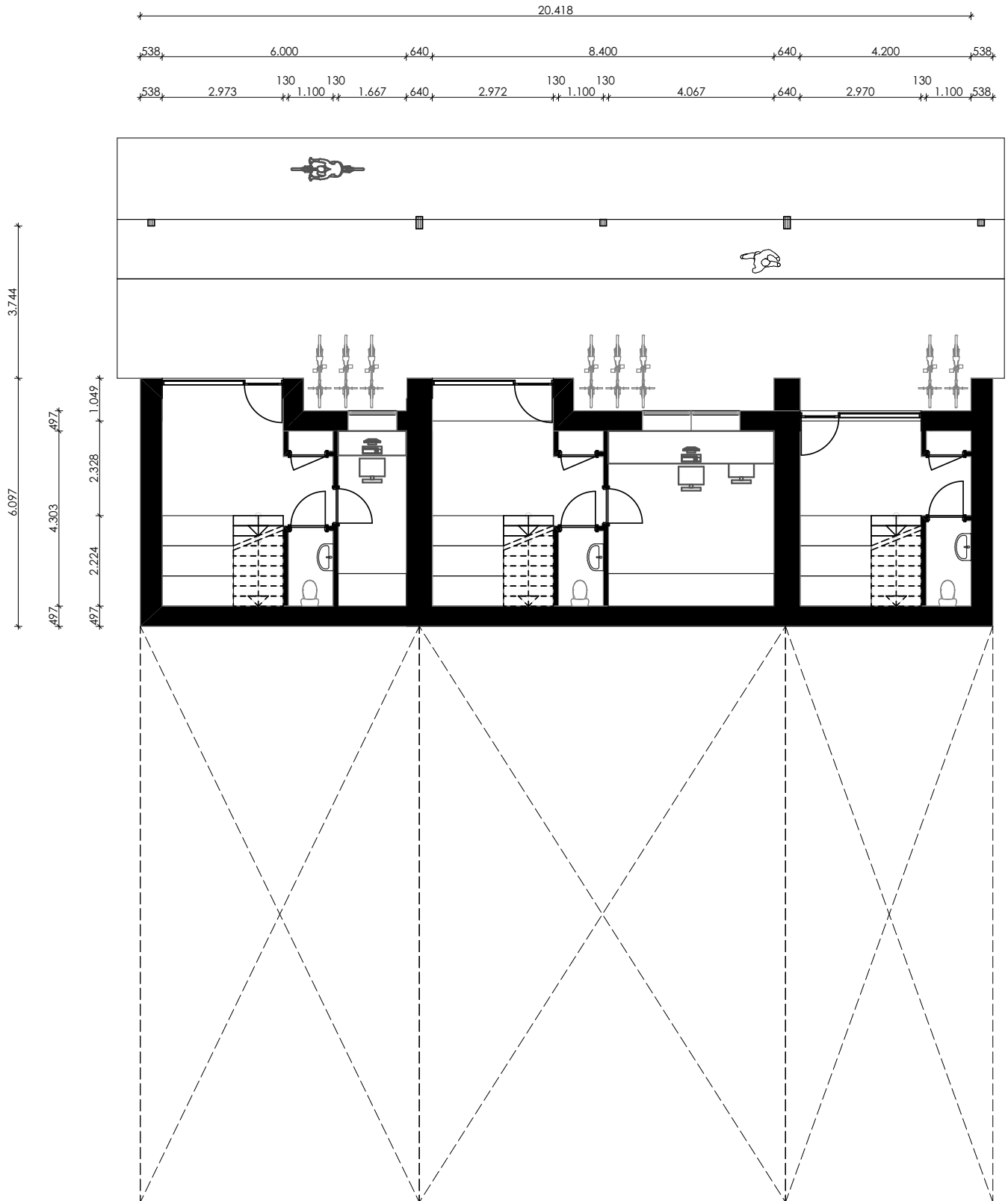
North and South facade



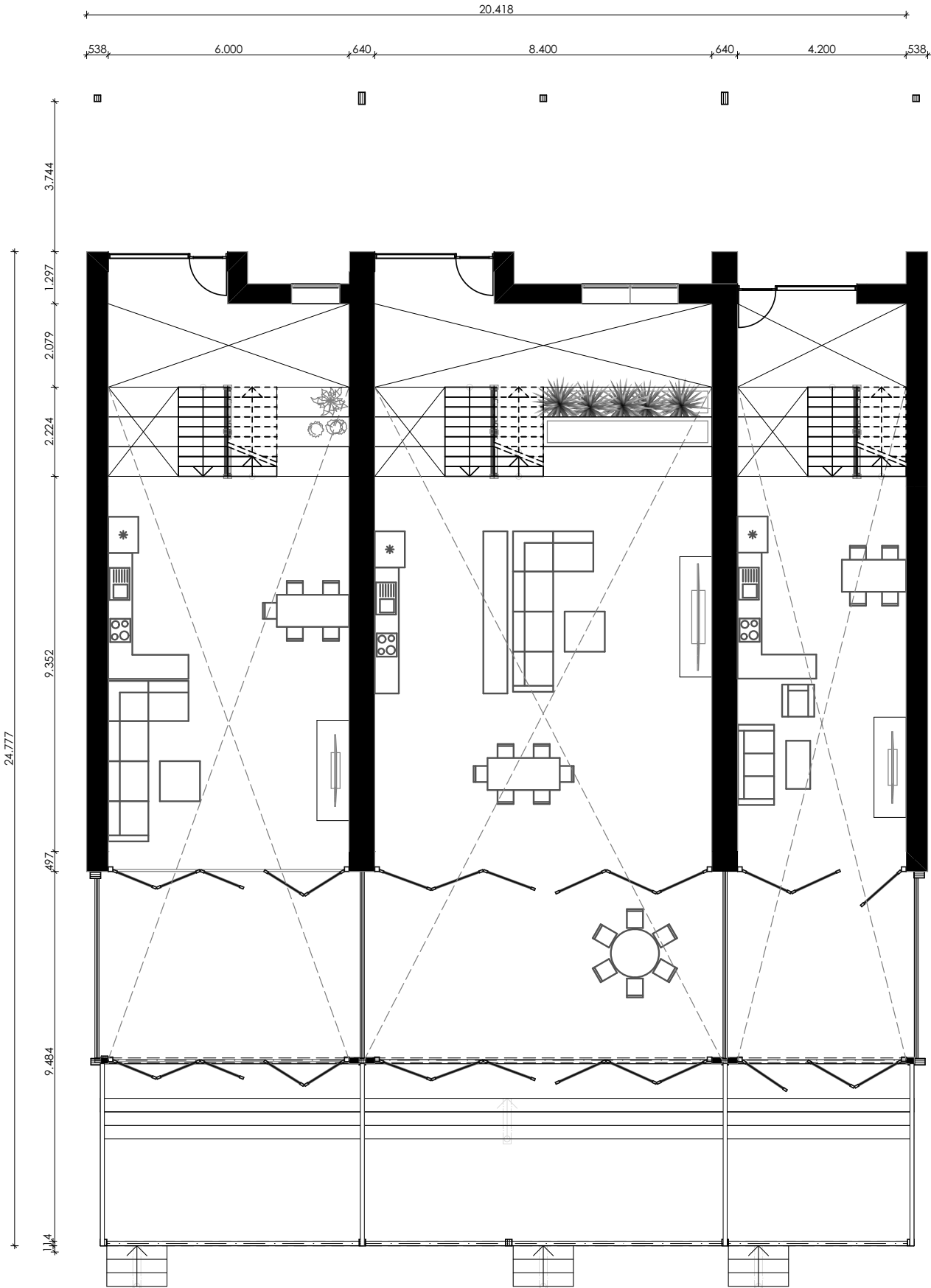
West facade



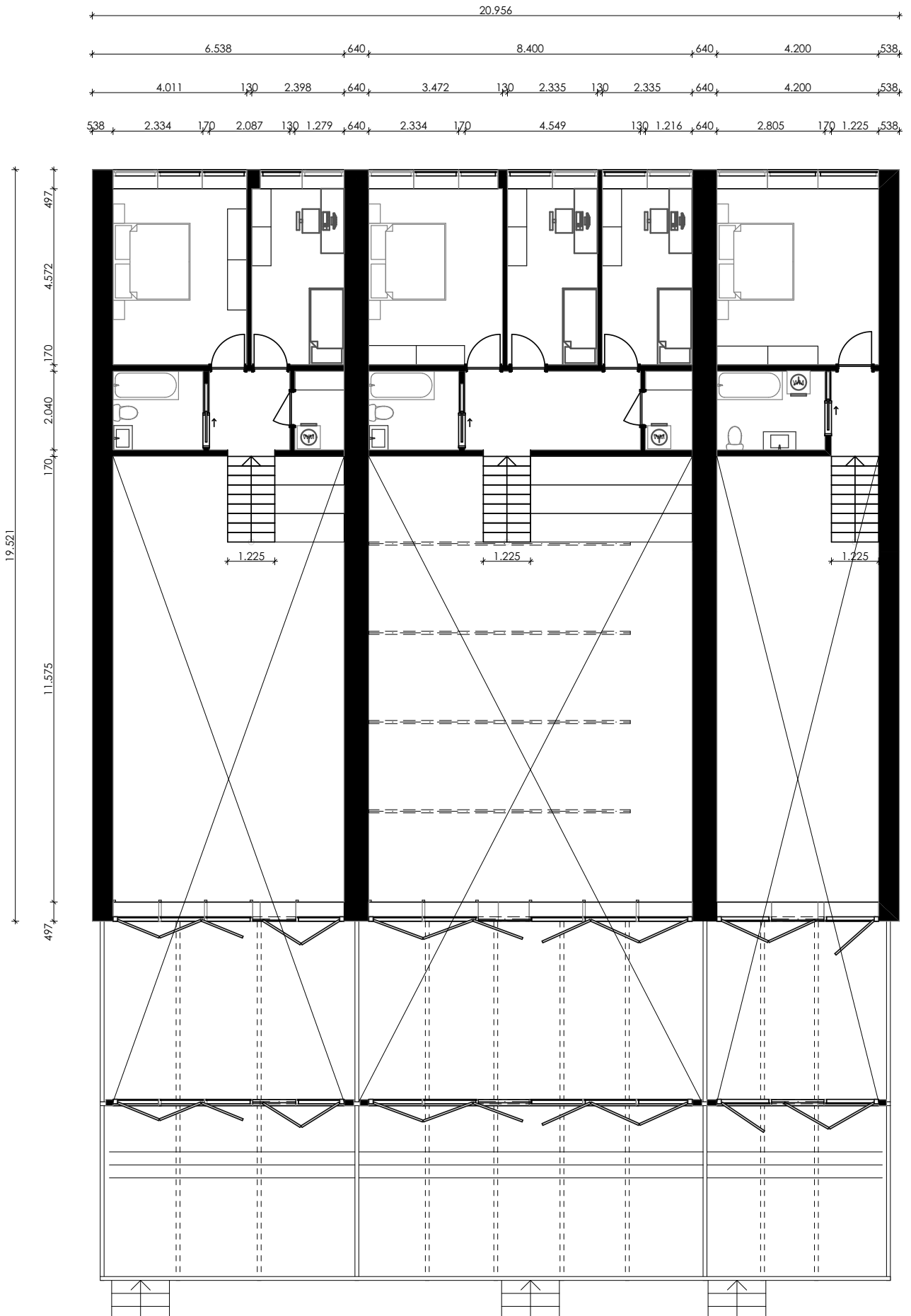
First floor (P=6070)

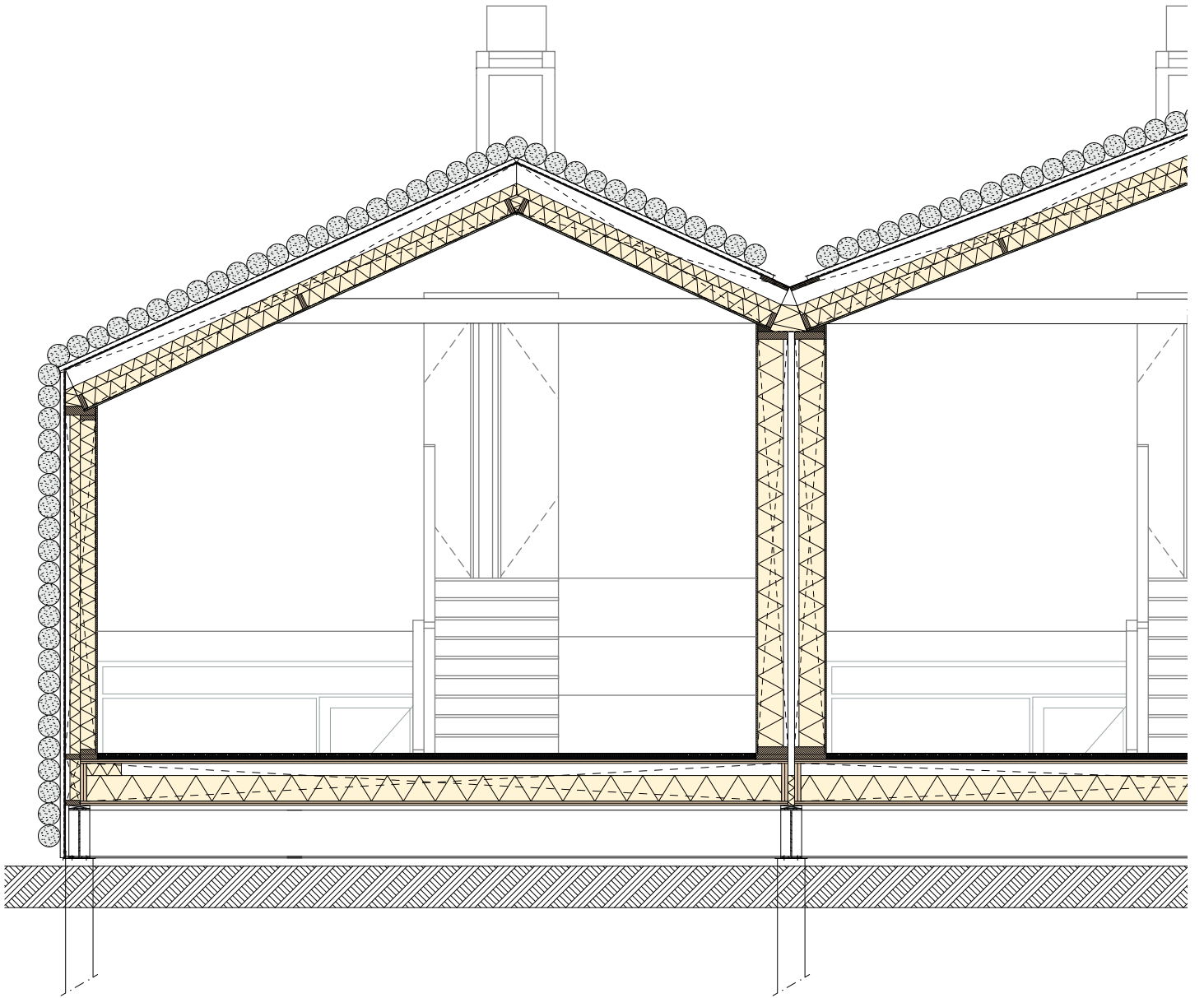


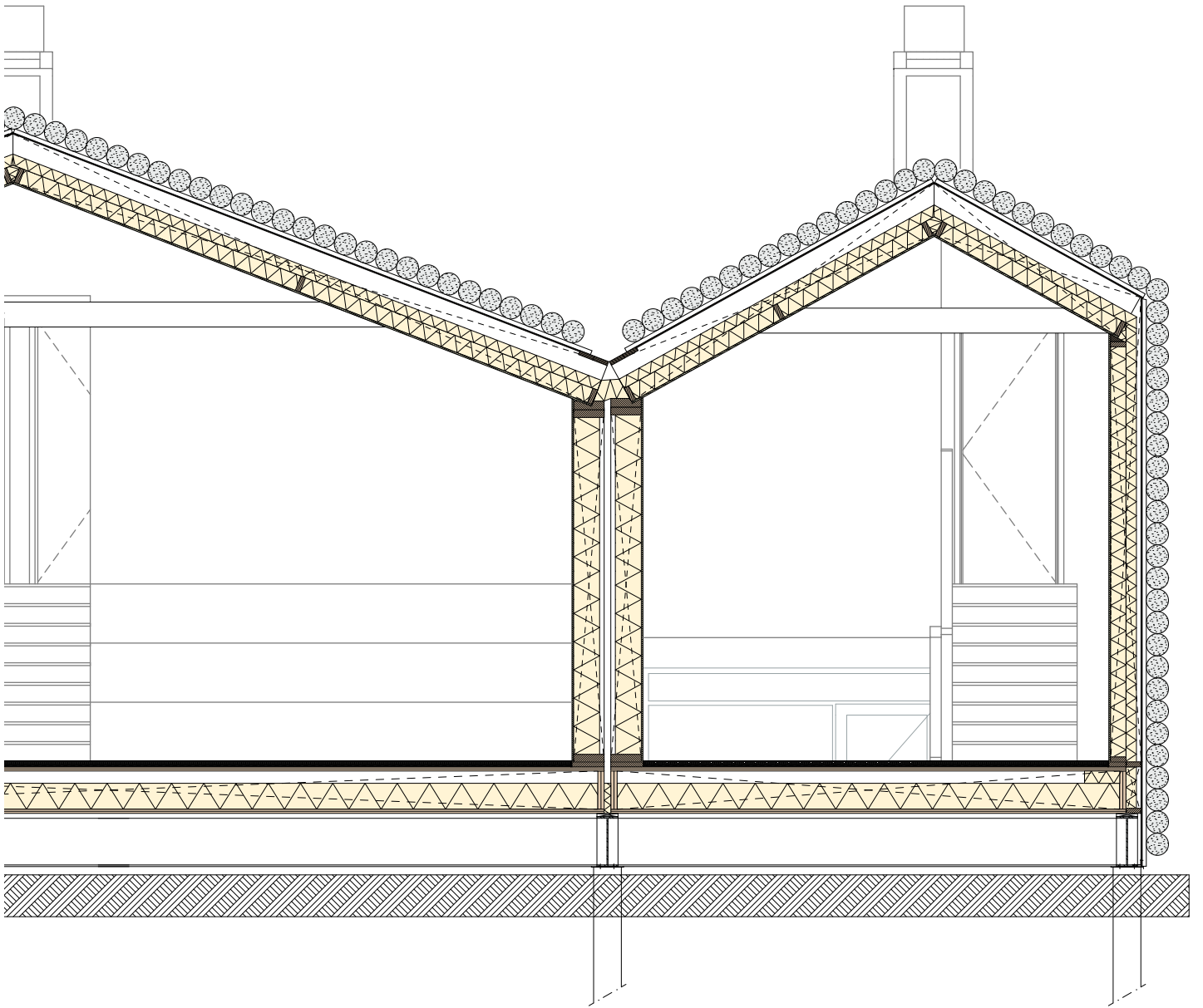
Second floor (P=7670)



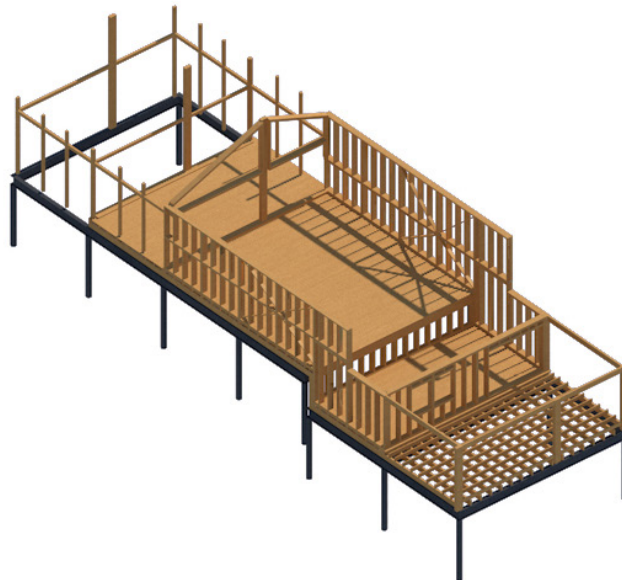
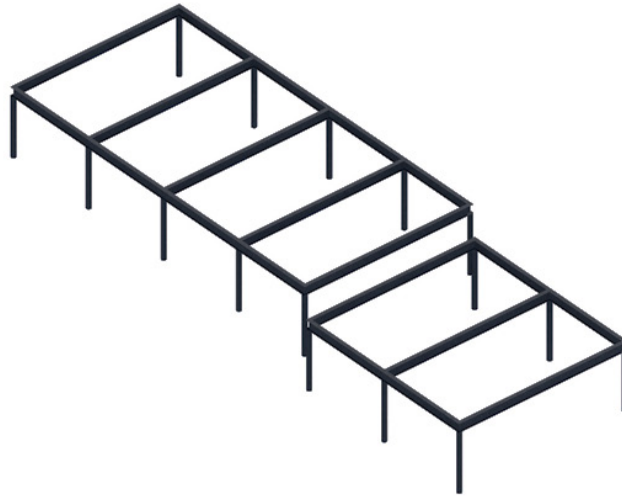
Third floor (P=9270)

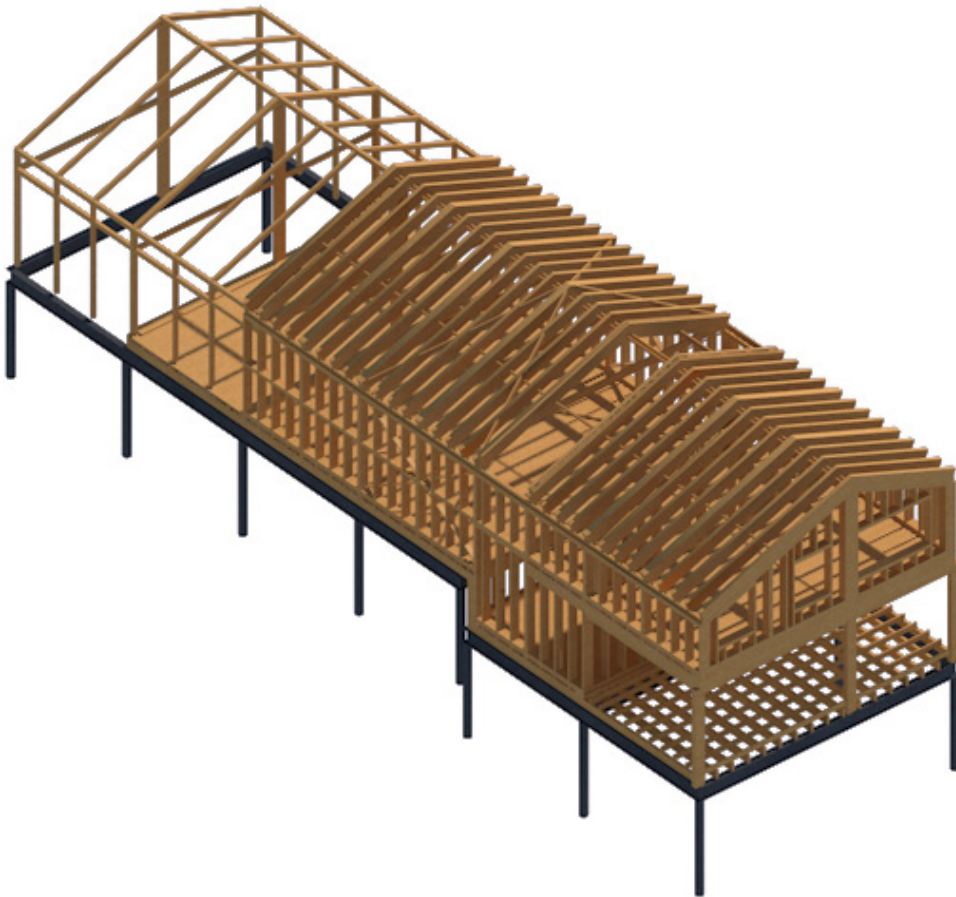
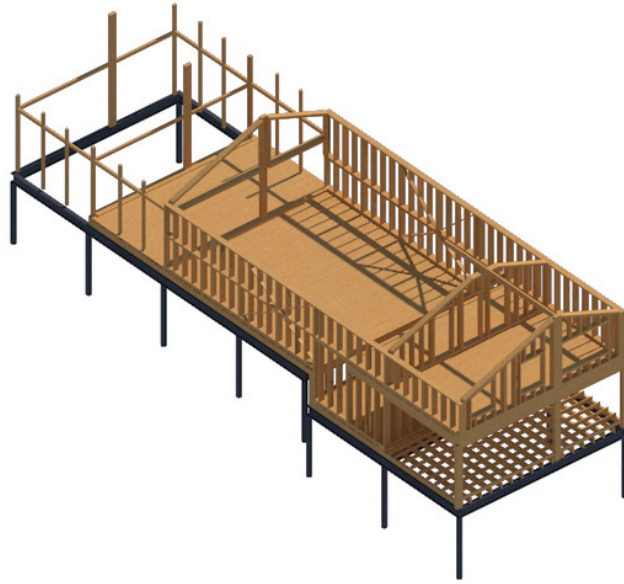






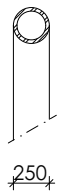
Structure



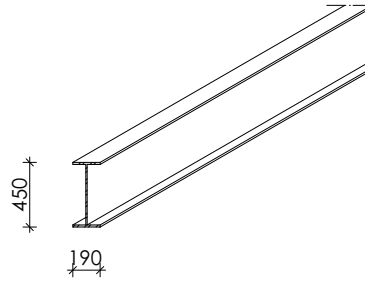


Structure

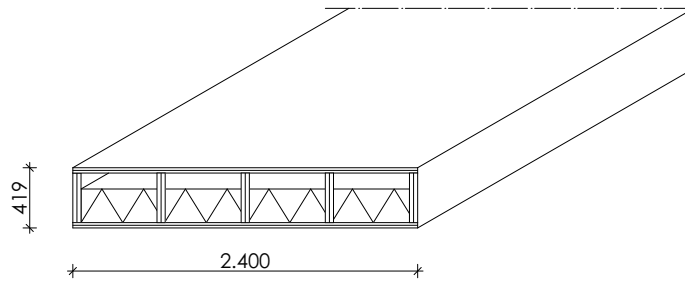
Demountable elements



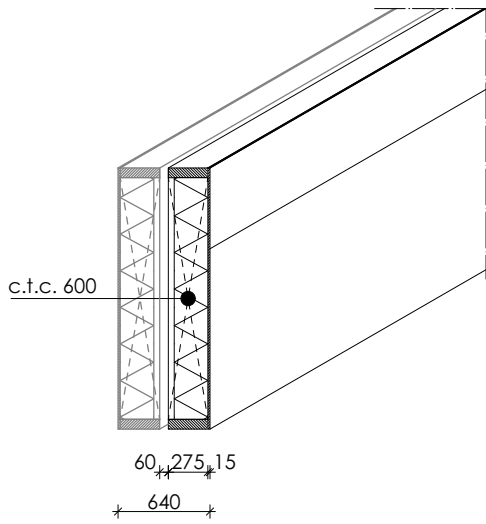
Hollow foundation poles



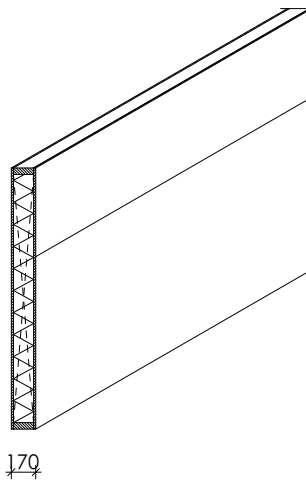
Steel foundation beams IPE 450



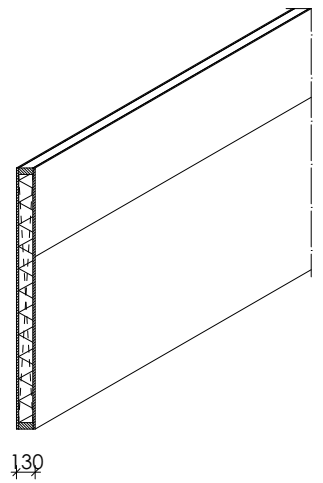
Wooden hollow core slab floor
(kanaalplaatvloer)



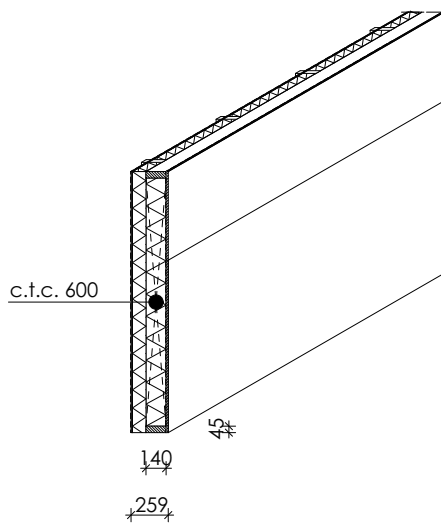
Separating wall



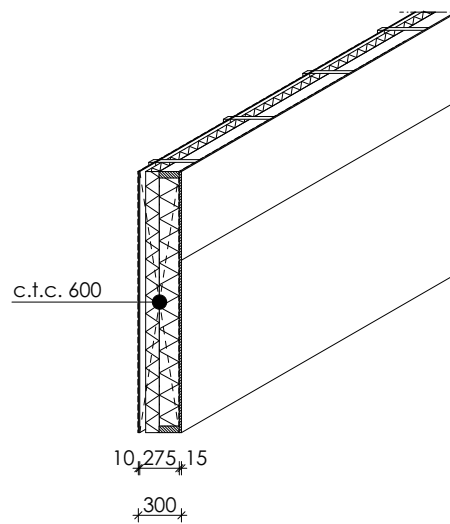
Internal walls bathroom



Internal walls



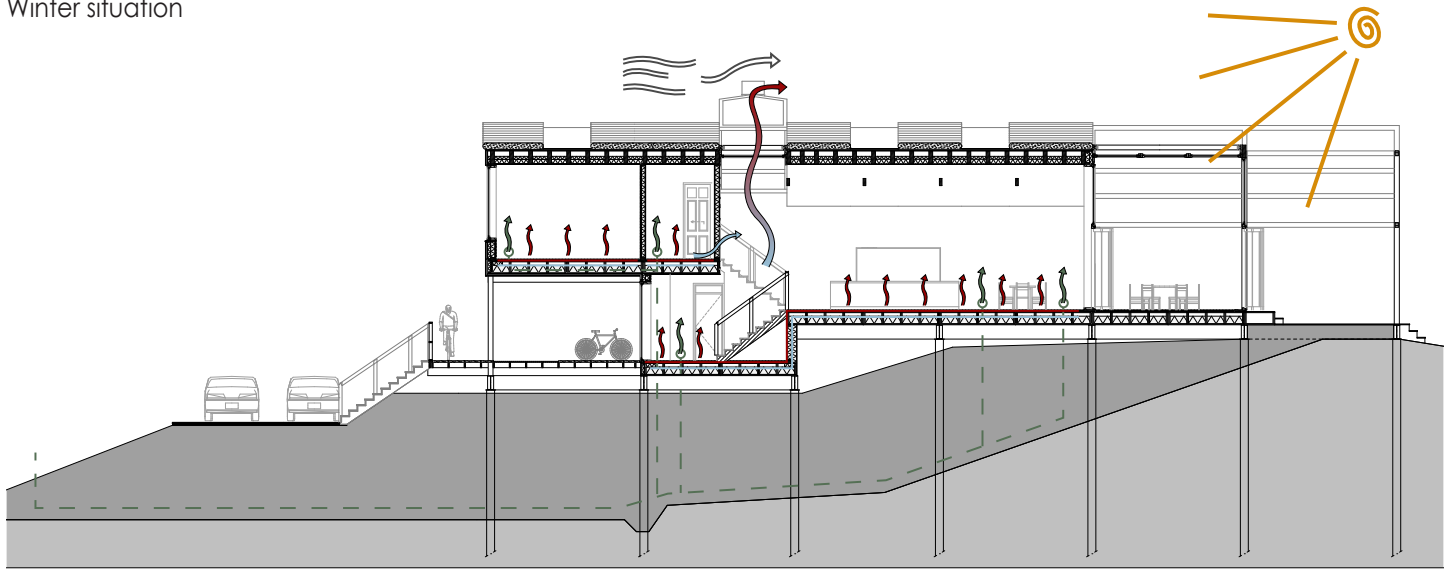
Outside wall non bearing



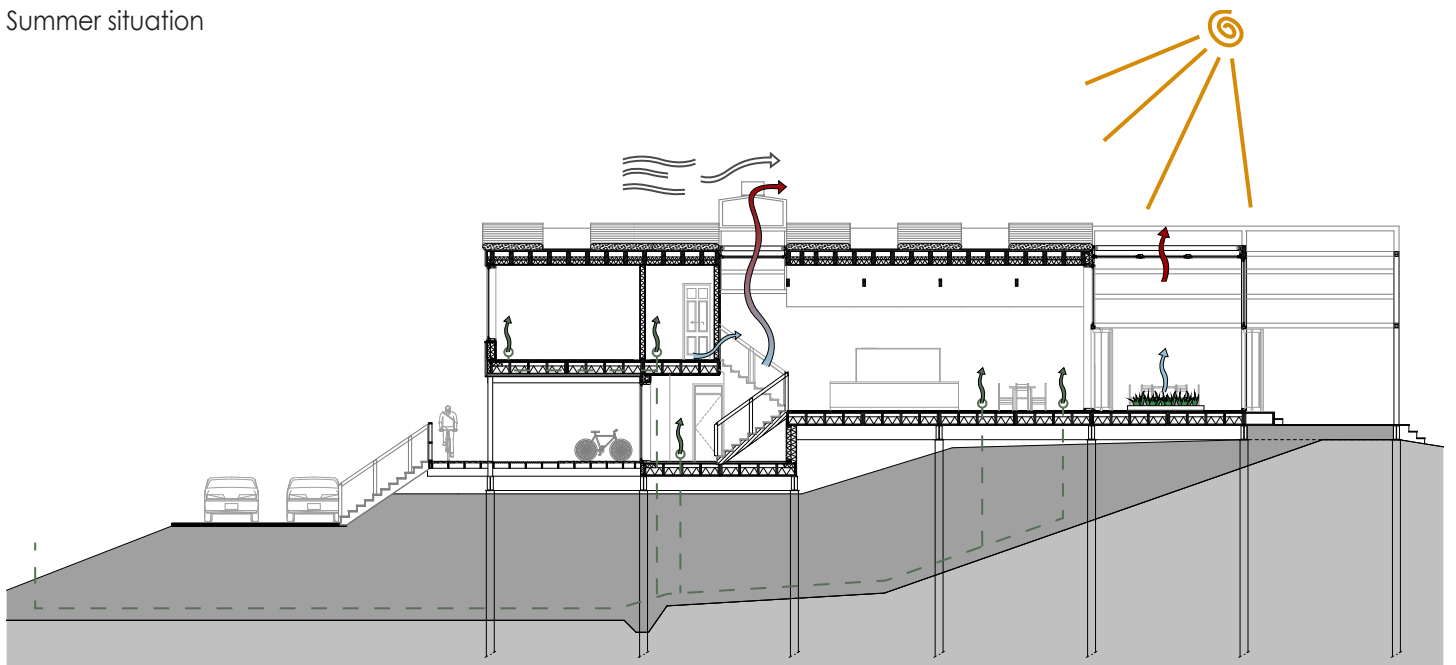
Outside wall bearing

Climate

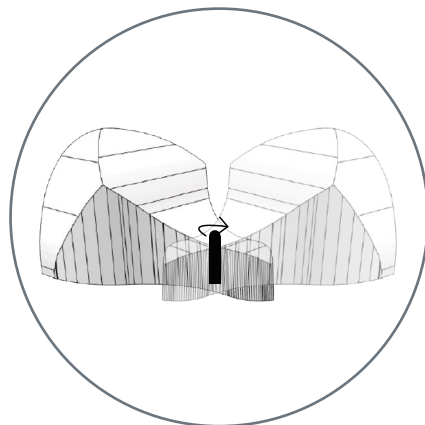
Winter situation



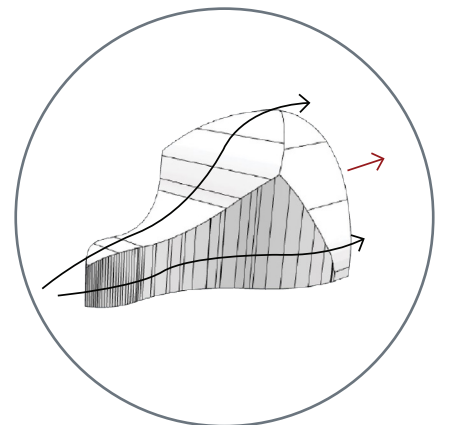
Summer situation



Passive ventilation



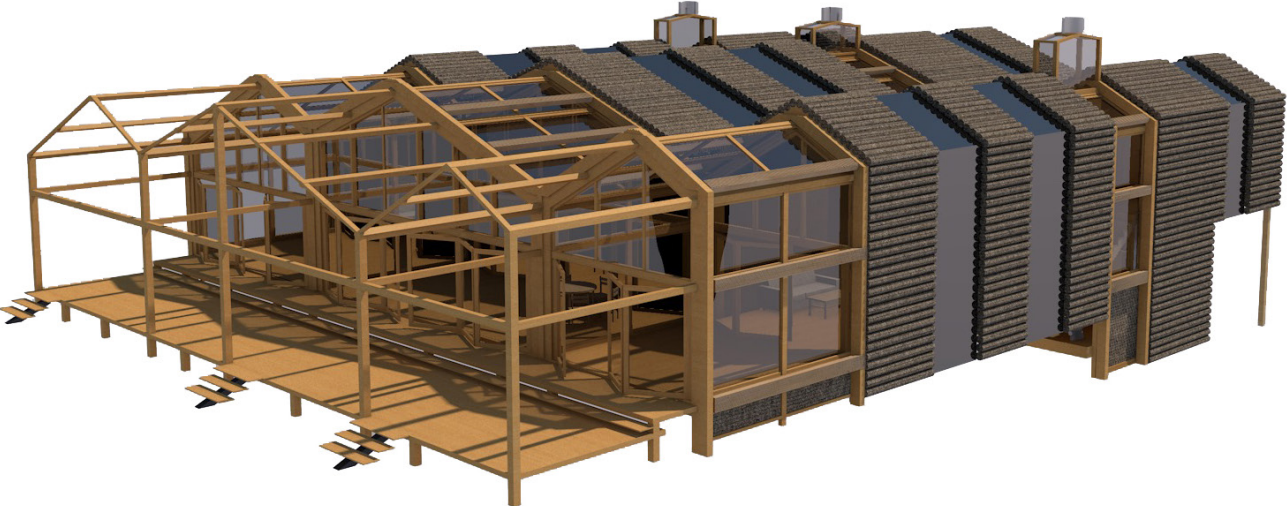
Turning point



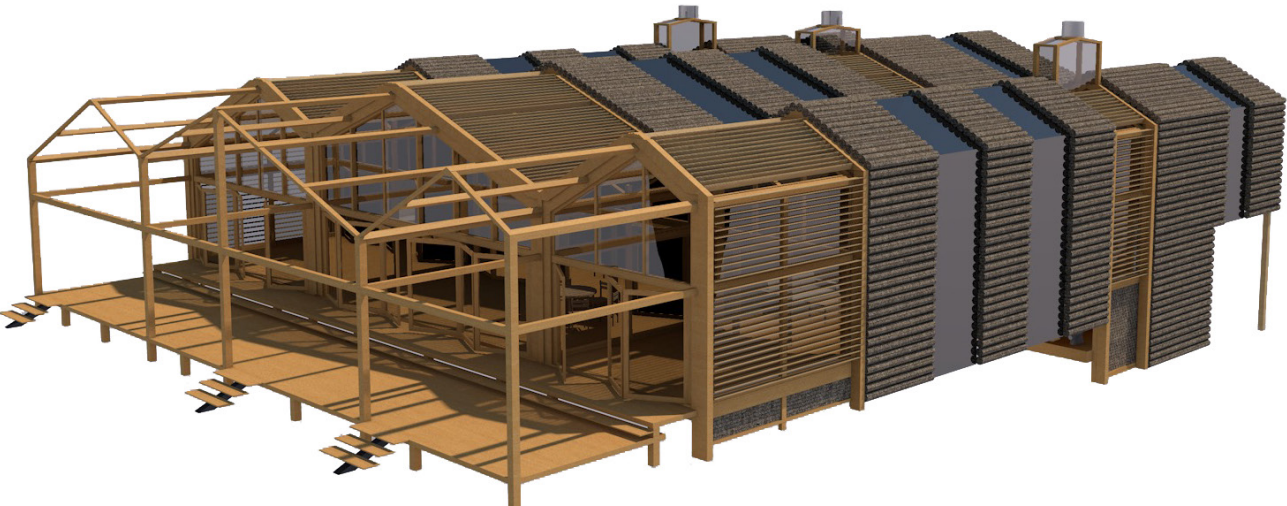
Negative pressure

Sun shading

- open



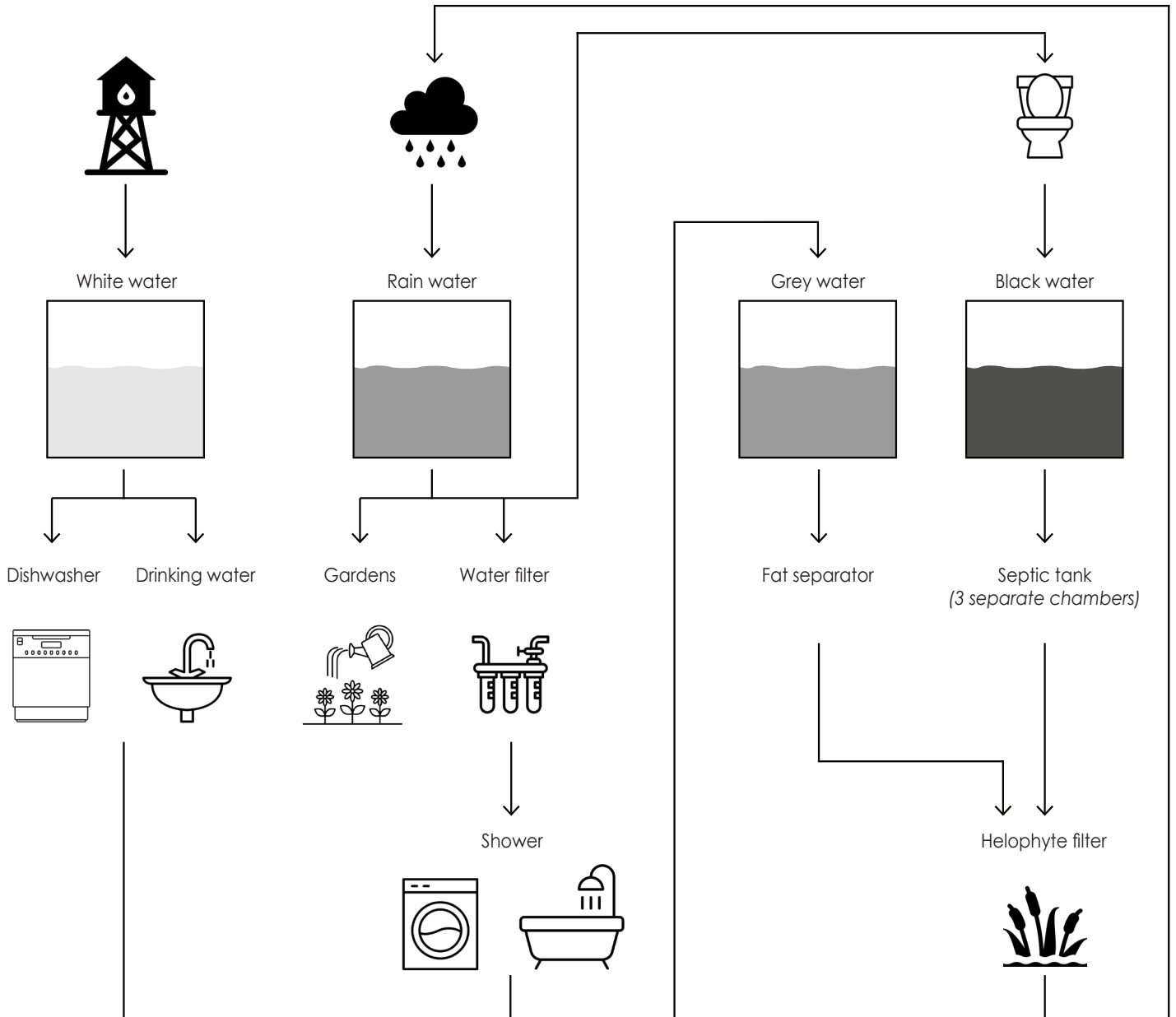
- semi closed

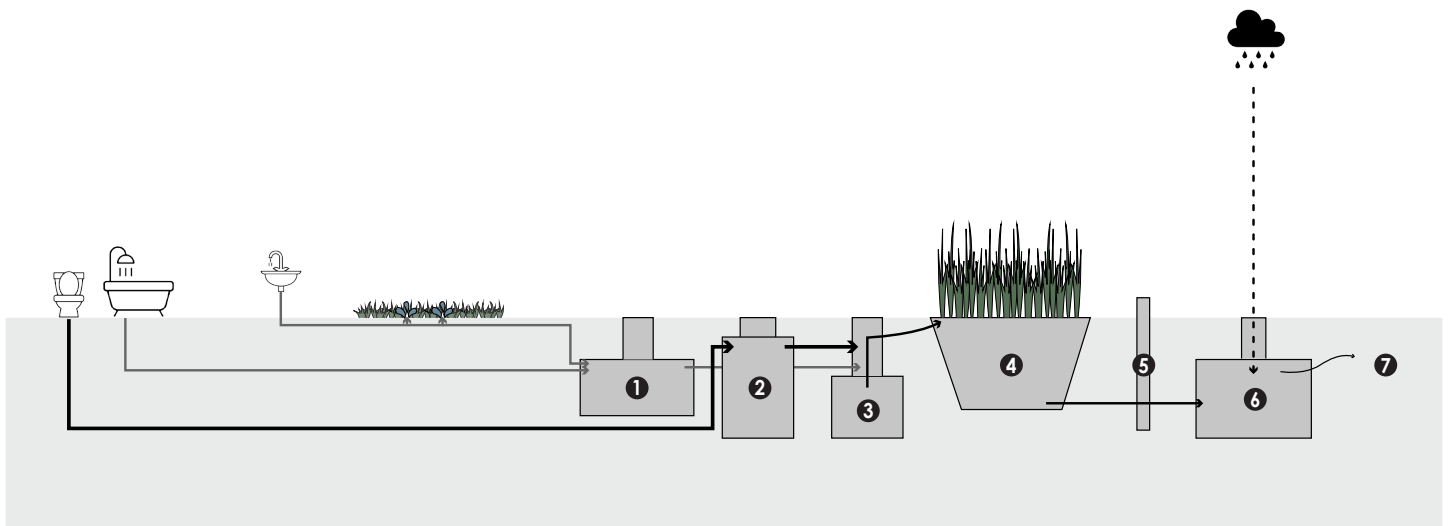
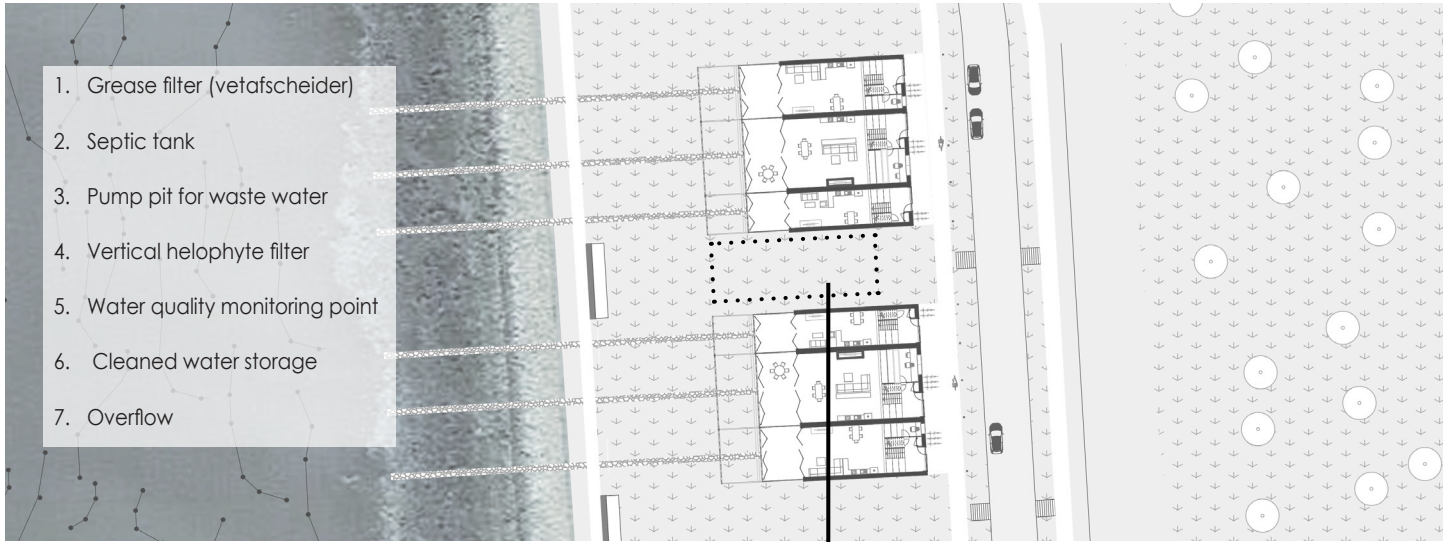


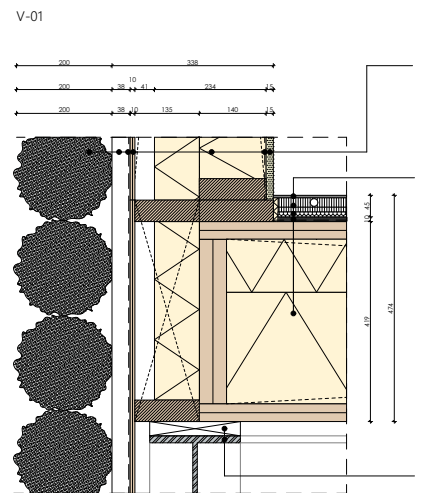
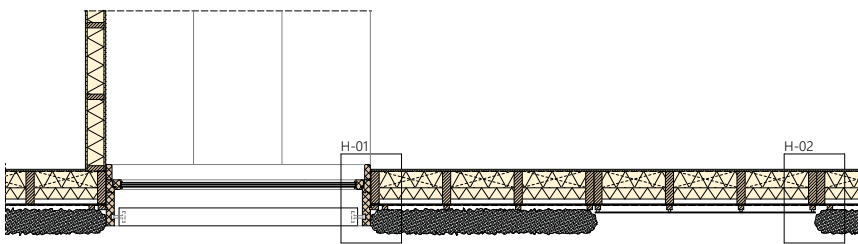
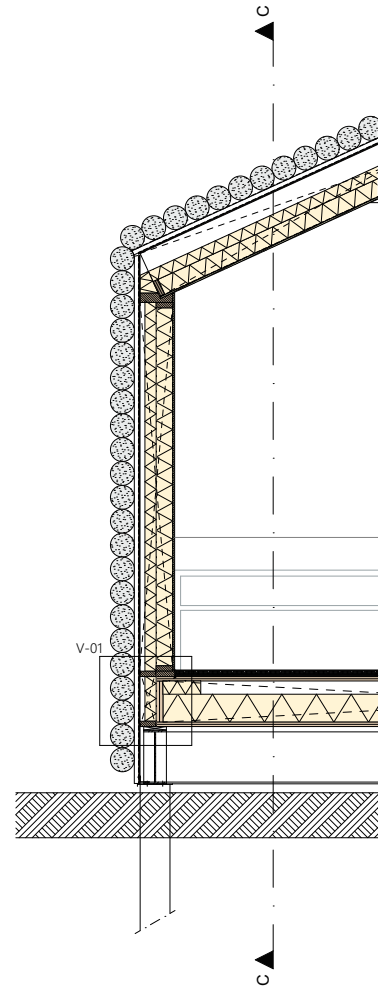
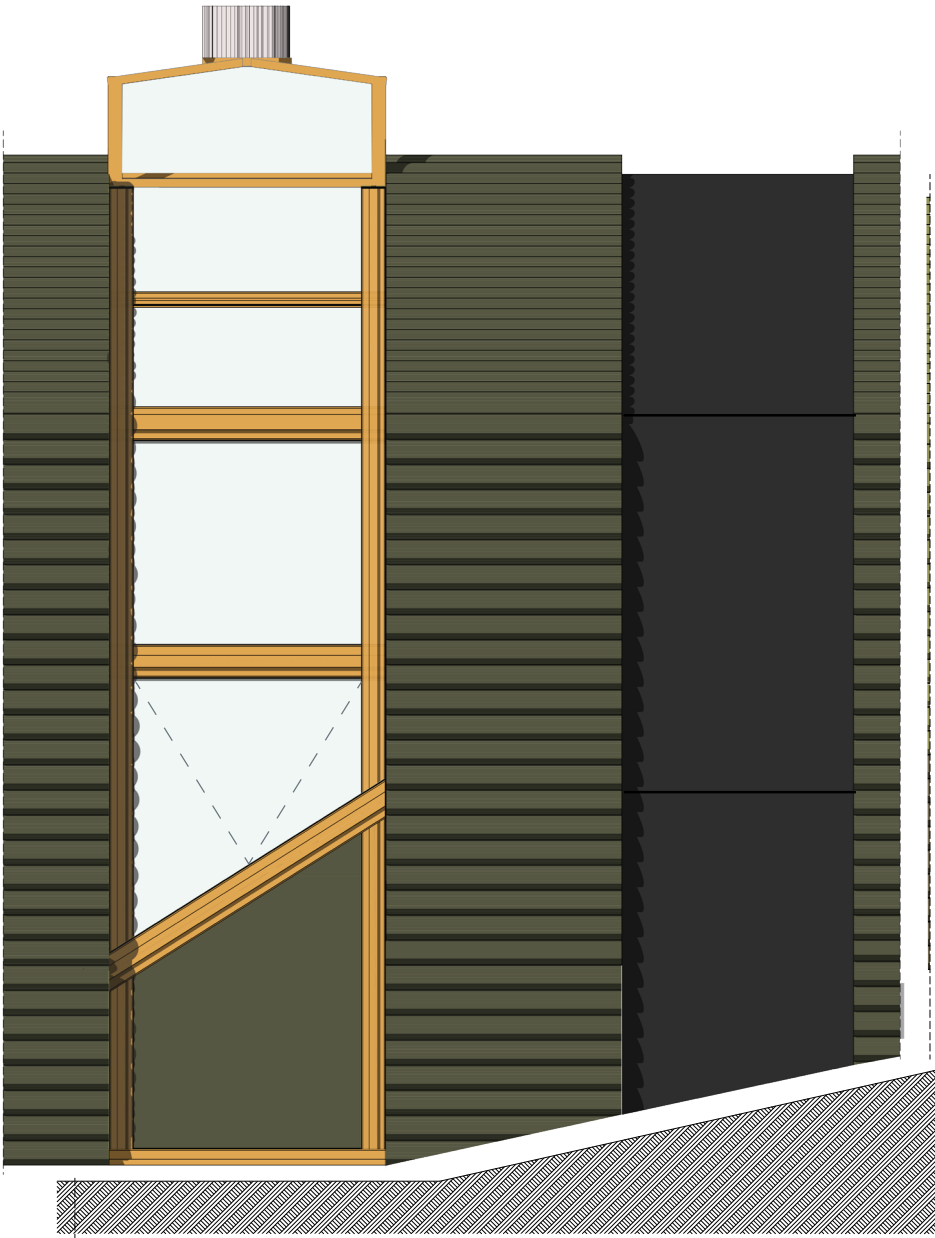
- closed

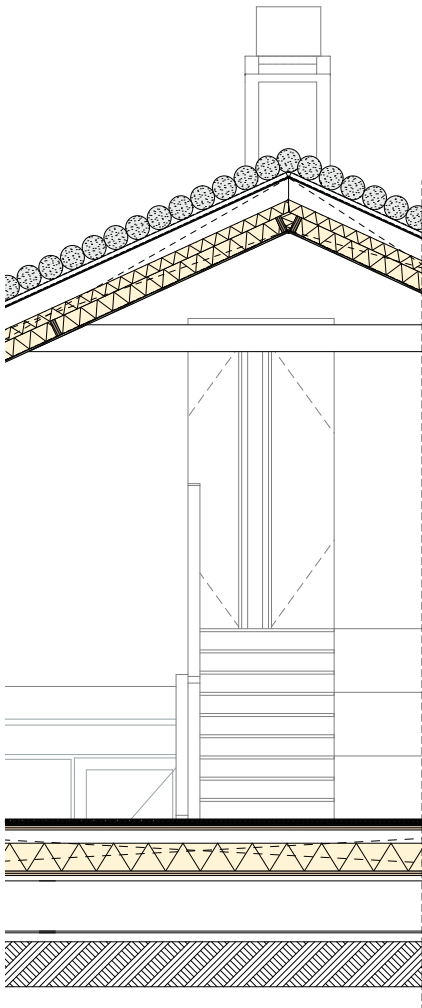


Water cycle

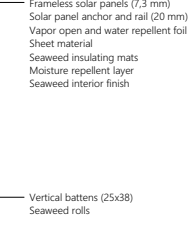
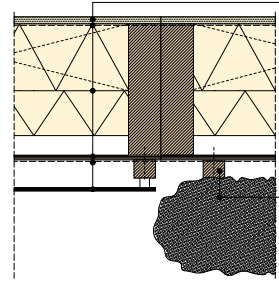
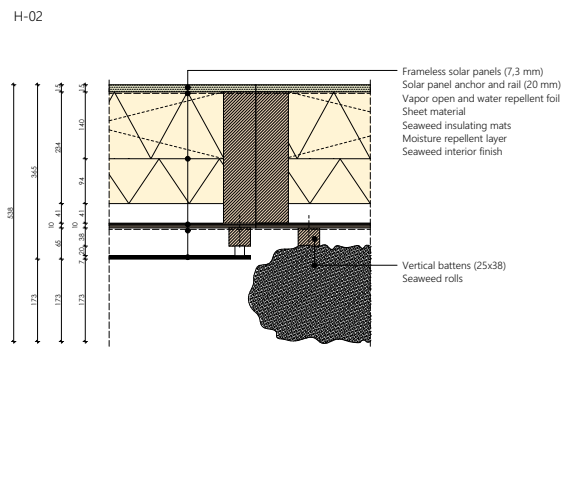
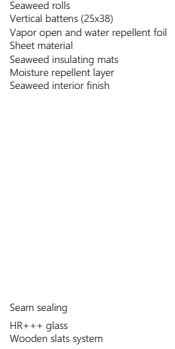
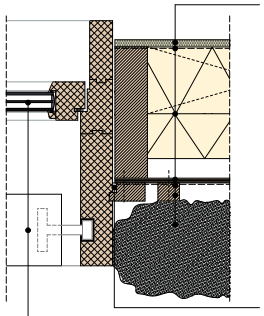
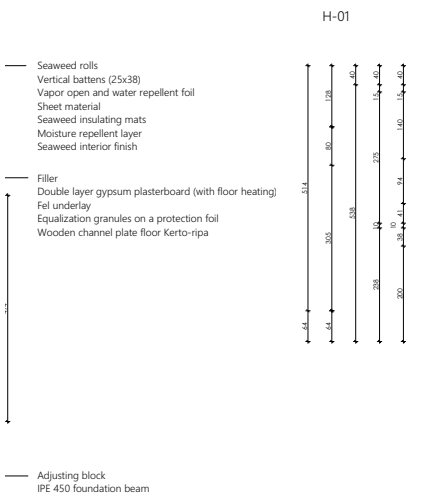
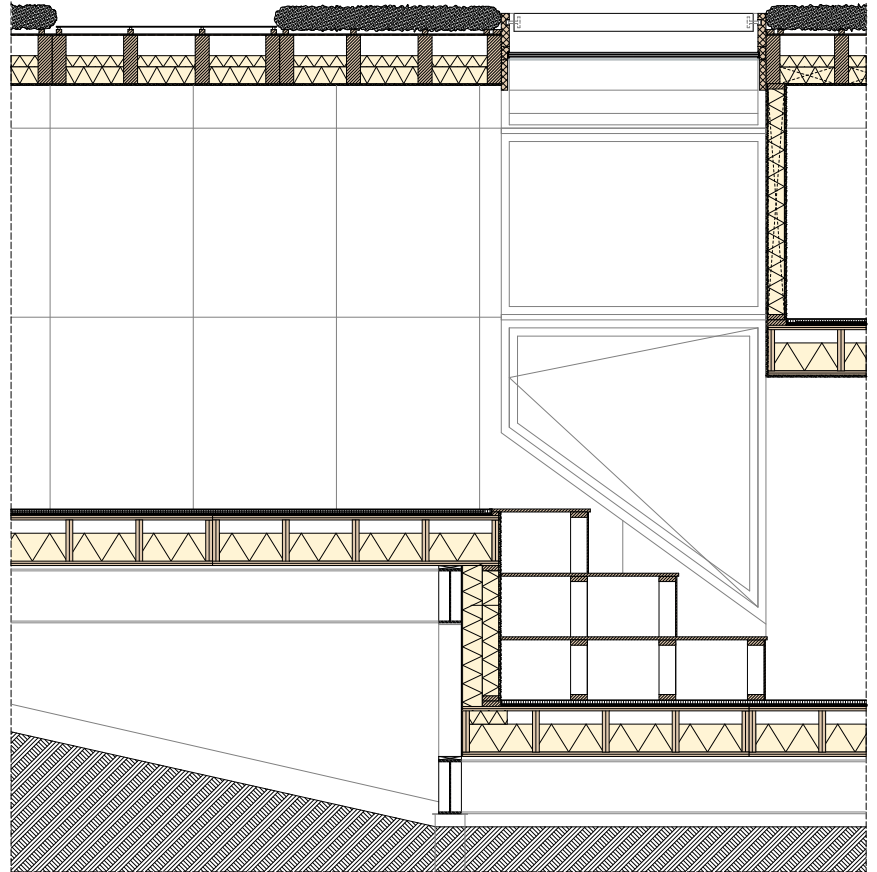








Section C-C



Roof calculation

Gewichtstabel Dakconstructie H.O.H lengte 600 mm

Onderdeel	Oppervlakte [m²]	Hoogte [m]	Gewicht/belasting kg/[m²]	Blijv. Belasting [kN]	Ver. Belasting [kN]	Fact.	Reken [kN]	
Dak								
Isolatie Materiaal =	3,3504	0,234	63,4	0,49		* 1,2	0,58	
Zeewierrollen (nat) =	0,876688	0,6	634	3,27		* 1,2	3,92	
sneeuw =	3,3504		0,84 [kN/ m²]		2,81	* 1,5	4,215	
wind =	3,3504		0,64 [kN/ m²]		2,14	* 1,5	3,22	
							Totaal:	11,92

DRUKSTERKTE BEREKENING

11,92 KN per 600mm dakoppervlakte

Houtklasse C24 vurenhout (europa)

$$f.c.o;rep = 21 \text{ N/mm}^2$$

$$x * y = a$$

$$a > 11,92 \text{ KN} / 21 \text{ N} = 568 \text{ mm}^2$$

x en y geven erg lage benodigde afmetingen voor druk > isolatiewaarde dikte minimaal 234

Keuze -> standaard waarde hout = 235 * 38

$$a = 8930 \text{ mm}^2 > 568 \text{ mm}^2$$

Voldoet

BUIGSTERKTE BEREKENING

$$W = (5/384) * (Q * L^4 / E * I)$$

$$I = (BH^3) / 12$$

maximale toegestane doorbuiging = L/600

maximale lengte = 5584

$$5584 / 600 = 9,3$$

$$9,3 = (5/384) * ((1,379 * 5584^4) / ((11 * 10^3) * I))$$

$$I = 1,7 * 10^7$$

$$(BH^3) / 12 = 1,7 * 10^7$$

$$BH = 45311$$

$$a > 45311 \text{ mm}^2$$

standaard houtformaat gekozen:

$$360/3 = 120 \rightarrow 360 * 117 = 42120 \text{ VOLDOET NIET}$$

$$405/4 = 101 \rightarrow 405 * 117 = 47385 \text{ VOLDOET}$$

Gekozen Houtformaat = 405 * 117 inplaats van de op druk berekende 235 * 38 vanwege doorbuiging.

SPATKRACHTEN BEREKENING

Houtklasse C24 vurenhout (europa)

$$p.rep = 250 \text{ kg/m}^3$$

12000 daklengte -> h.o.h 600 = 20 balken

$$\text{V-Balk AC} \rightarrow (405 * 117 * 5584) * 20 = 5,2919568 \text{ m}^3$$

$$\text{H-Balk AC} \rightarrow (140 * 45 * 3 * 12000) = 0,2268 \text{ m}^3$$

$$\text{V-Balk BC} \rightarrow (405 * 117 * 3800) * 20 = 3,60126 \text{ m}^3$$

$$\text{H-Balk BC} \rightarrow (140 * 45 * 3 * 12000) = 0,2268 \text{ m}^3$$

$$\text{Tot Constructiehout AC} = 5,5187568 \text{ m}^3$$

$$5,5187568 \text{ m}^3 * 350 \text{ Kg/m}^3 = 1931,56488 \text{ Kg/0,6m} = 18,9422 \text{ KN}$$

$$\text{Veiligheidsfactor} * 1,2 = 22,73064 \text{ KN}$$

$$\text{per 600mm dakoppervlakte} = 22,73064 / 12 \text{ meter} * 0,6 \text{ m h.o.h oppervlakte} = 1,136532 \text{ KN/0,6m}$$

$$\text{Tot Constructiehout BC} = 3,82806 \text{ m}^3$$

$$3,82806 \text{ m}^3 * 350 \text{ Kg/m}^3 = 1339,821 \text{ Kg/0,6m} = 13,1392 \text{ KN}$$

$$\text{Veiligheidsfactor} * 1,2 = 15,76704 \text{ KN}$$

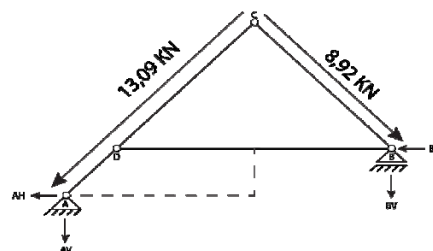
$$\text{per 600mm dakoppervlakte} = 15,76704 / 12 \text{ meter} * 0,6 \text{ m h.o.h oppervlakte} = 0,788352 \text{ KN/0,6m}$$

Totale belasting per 600 mm dak:

$$\text{Belasting exclusief dakconstructie} = 2,13992424 \text{ KN/0,6m}$$

$$3800 * 2,13992424 + 0,788352 = 8,92 \text{ KN}$$

$$5584 * 2,13992424 + 1,136532 = 13,09$$



$$AH = 5213/5584 * 13,09 = 12,22 \text{ KN}$$

$$AV = 2000/5584 * 13,09 = 4,69 \text{ KN}$$

$$BH = 3548/3800 * 8,92 = 8,41 \text{ KN}$$

$$BV = 1362/3800 * 8,92 = 3,20 \text{ KN}$$

Totale horizontale kracht = 20,63 KN / 0,6m

Totale horizontale kracht dak = 29471,4 N

Houtklasse C24 vurenhout (europa)

f.t.;rep = 14 N/mm²

29471,4 / 4 balken = 7367,85 mm² per balk benodigd

135 * 68 = 9180 mm²

9180 mm² > 7367,85 mm²

Voldoet. Maar keuze wijkt af, met een grotere afmeting, wegens esthetische redenen en mogelijkerwijze doorbuiging van de dwarsbalken. Deze doorbuiging wordt echter ook tegengegaan door de constante trekkracht in de balk.

Zeewier gewicht:

<https://www.aqua-calc.com/calculate/food-volume-to-weight>

Gedroogd: 63,4 kg/m³

Verzadigd: 10x zijn eigen gewicht

Stalen funderingsbalken:

hoogte = $1/20 \times \text{lengte}$

lengte = 9 meter max.

$1/20 \times 9000 = 450 \text{ mm.}$

Gekozen: IPE 450

Houten vloerbalkhoogte:

Hoogte = $1/20 \times \text{lengte}$

$1/20 \times 5000 = 250 \text{ mm}$

Breedte = $1/3 \text{ à } 1/4 \times \text{hoogte}$

$1/4 \times 250 = 62,5$, afgerond 63 mm.

Houten kolom:

Breedte = $\text{lengte}/20$

$3000/20 = 150 \text{ mm.}$

Houten kolom HSB wanden:

$5500/20 = 275 \text{ mm}$

Zeewier gewicht:

<https://www.aqua-calc.com/calculate/food-volume-to-weight>

Gedroogd: 63,4 kg/m³

Verzadigd: 10x zijn eigen gewicht

